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ABSTRACT

Based on experience and research findings, this paper discusses the advantages of using an integrated computer based teaching unit consisting of a textbook, educational software, and applications software. It is suggested that the textbook should provide basic background material on the topic, the courseware should be used for simulation, and the application software should demonstrate current applications of the topics studied. A description of the design of such a module for teaching industrial accounting is provided as an example. Four references are included. (MES)

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THE INTEGRATED TEACHING UNIT

A NEW APPROACH TO COMPUTER ASSISTED EDUCATION

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1) INTRODUCTION

The computer has been doing profitable and universally recognized work in the technical and organizational sector of the business world, proving itself to be an insubstitutable aid in the activities of planning, design, forecasting and allocation of productive resources, etc.

Terms like Computer Aided Design, Computer Aided Engineering, Computer Aided Manufacturing, as well as their corresponding abbreviations , CAD, CAE, and CAM, have already been part of our current terminology for some time now, testifying to the ever growing recourse we make to the computer in order to solve any and all problems. Recently, two new terms have been added , Computer Based Education (CBE) and Computer Integrated Manufacturing (CIM). The first term refers to the use of the computer as a teaching and professional development aid, and the second term, CIM, refers to the automatic approach in the development of the production process.

What this means is that to use CIM procedures , you should to first use CAD in product design, and then MRP in the planning and management of production resources.

The use of "Computer Based" procedures undoubtedly seems to be advantageous for all activities having to do with industry management.

What follows will pause and illustrate, among other things, the convenience of Integrated Computer Based Procedures to the solving of one particular managerial problem.

In particular, the profitability of using integrated procedures when dealing with automation will be shown , as well as the usefulness of CBE for the training of and professional activity of a manager with regards to industrial economic control.

In this sector, a series of applicative software is available, dealing with budgets, production costs, etc.

Likewise, it is possible to find CBE coursewares intended for both beginner and advanced learners, furnishing the knowledge of the fundamental principles which are at the bottom of the most common procedures dealing with managerial economic control.

This paper illustrates how, starting with the idea of global integration, we have come to develop a "Computer Based" Integrated Unit, aimed at the finding of profitable solutions for problems connected with professional training and the carrying out of techniques first grasped in the training phase.

Only a wedding of educational and applicative softwares conceived and built in an integrative manner can most realistically solve, in the most efficient manner possible, the problems in both areas.

This type of integrated unit can prove to be very useful in the learning of fundamental management principles. Infact, when resorting to CBE methodologies, the possibility of practicing the various accounting procedures is given to the learner.

The opportunities offered by the computer in the teaching field are used best by utilizing the "problem solving" and "simulation" techniques. Developing courseware with these techniques, the apprehension and memorization of theories turns out to be facilitated, more enjoyable, and longer lasting.

Lastly, the availability of applicative softwares which are compatible to the theoretic principles already learned assure the user of having applicative software where the theoretical bases are clearly laid out.

In light of my own personal experiences, I feel that it is wise to mention that one of the biggest obstacles which the user encounters using applicative softwares is based upon the noticeable lack of information the latter posess in regards to the theoretical principles on which the programs have been based.

Because of this, one might hesitate to use these softwares, for fear of having to utilize procedures whose basic working theories are not known.

These ideas thus express the need to integrate the learning as well as the practice phase.

This paper , other than illustrating an example of an Integrated Computer Based Unit, also explains the process of study, testing and feed-back, which, starting out as a use of the computer in the management control sector, and in the teaching sector, considered initially to be two separate entities, led me to new vision, which coordinated the methodologies and instruments in question , a vision which then brought forth a critical analysis of all the experiences which took place in over two years of work.

2) CRITICAL ANALYSIS OF PREVIOUS EXPERIENCE

Teaching methodologies based on programmed instruction , and the intensive use of multi-media teaching aids known as Computer Based Education (CBE), are almost universally known for thei utility in the teaching as well as the professional training sector. /1/2/3/

On the basis of my experiences, I've had the chance to develop, in collaboration with my Department's researchers, or with the help of outside software houses, a series of coursewares, dealing with my specific sector, as well as other sectors, in the latter case with strictly experimental aims, of course.

In particular, in the industrial engineering sector, a courseware was developed which dealt with the assembly and maintenance of a work station, and another courseware dealing with the use of Harris and Eilon's theories for the calculation of Economic Manufacturing Quantity in the case of multi product production.

In the service sector, there has been developed a group of coursewares intended to train the personel of a banking institute, using new banking procedures.

The most significant elements of the aforementioned coursewares are, in my opinion, the use of a video tape set, and a simulation procedure of an IBM 3270 video terminal. For coursewares in both the manufacturing and service sector, a "Learning Station" was used, consisting of a personal computer linked to a monitor and a video tape recorder.

This configuration of hardware allows one to integrate the textbook's pages and the digitalized graphics generated and visualised on the personal computer's video screen with images captured live by means of the camera, and visualised on the additional graphic monitor.

An interface card and software permit the personal computer to "control " the activities of the video tape; consequently the search and visualisation of the sequence of images chosen by the instructor are completely controlled by the Central Power Unit of the work station.

As easy as it is to imagine the use of videc tape, it has been proven extremely useful and efficient from the instructors standpoint.

It had also been proven much more economical and also easier to use than a video disk unit. In fact, the productior costs of a video disk are, even today, too high, and the production procedure too complex so as to seriously discourage it's use.

The production of a simulation procedure and Main Frame IBM terminal permit the learner to practice use of the terminal directly on a personal computer, without having to abandon the learning process. "Exiting" from the courseware while he is still using it.

Lastly, in the fields outside of management, we have experimentally developed coursewares destined for the teaching of mathematics and the English Language in Junior and High Schools.

By grouping together all these experiences, along with the gathered information, and comparing them with work done by the colleaugues of other Universities, it definetly seems appropriate to group together the critical considerations which follow.

1) The interactive teaching methodologies are immediately accepted by the learners, but not always by the instructors. In fact, the latter are usually reluctant to abandon, or at least combine, traditional teaching methods to use CBE ones, based on the use of advanced technological media still not widely known to them.

2) To widen the use of CBE methodologies in teaching, it is necessary to involve the instructors themselves in the developing of the coursewares . Educational software developed outside of the teaching structure which will use them frequently give rise to the eventual rejection by the instructors.

3) The "text" of a CBE course has to be specifically thought out and developed in function of the particular characteristics of the interactive teaching methodology which one wants to use. One of the major obstacles in the diffusion of CBE methodologies is due to the almost total lack of "texts" devised specifically for Computer Based Education. Currently, this field is experiencing a situation similar to the onewhich happened at the onset of the cinematographic age. During those times, the only scripts available were of theatrical operas; and even though these scripts were of undoubtedly excellent quality, they were just not able to effectively utilize the enormormous communicative capacities of this new means of communication.

4) To avoid using the courseware as a mere "electric page turner"with little practical use, it is suggested that in a CBE course, "Problem Solving" and "Simulation" techniques be widely used.
These techniques fully enhance the operating capacities of a computer and thus assure that a course based upon the use of the computer is of a much superior quality than an equivalent self instruction based on traditional teaching methods.

5) With these considerations in mind, it is better to have a courseware which has limited descriptive segments, and instead has extended exercises for which a computer is practically indispensable.

6) To avoid the limitations incurred with the descriptive segments, it is usefu for a CBE course to have an accompanying "text" which gathers and illustrates, ir a cohesive manner, the subjects presented for study. Furthermore, to assure that the theories learned by the student, and which he has had a chance to practice by means of a courseware , are immediatelly useful to him at the end of the learning period, it is necessary to have applicative softwares specifically conceived and produced with the theories the student has learned in mind.

7) My original idea was to develop the idea of Computer Based Training based or a series of correlated coursewares, but I was led from this to a new vision , which was the developing of the Interactive Unit, made up of the text book, coursewares, and applicative software.

Keeping this in mind, it is probable that in the near future, the concept of Computer Assisted Education will be gradually substituted by Computer Integrated Education, which is, in my opinion, much more rational and useful.

3) DEVELOPMENT OF AN INTERACTIVE INTEGRATED UNIT

The use of interactive teaching methodologies becomes particularly useful when one is dealing with academic disciplines characterized by a high number of technical, scientific and managerial arguments.

In the last case, the use of a courseware allows the student to practice on mathematical models which simulate the management of productive systems in ways which are often very revealing.

My aim being the diffusion and testing of CBE methodologies when I devised the Integrated Teaching Unit, I thought it useful to pick the argument to be dealt with from those that are better known and most important in the sector of economic control of management, which is a part of my University course.

So, then, I have focused on industrial accounting, and on the theories which are fundamental to this type of accounting.

In light of the critical considerations expressed in the preceding paragraph, the in depth and systematic treatment of the basic principles of industrial accounting has been deferred to the reading of a specific text. /4/

This text deals with the subject not only under the accounting profile, but also puts in evidence the advantages which management can have by the rational use of the information garnered from an industrial accounting procedure.

While dealing with this topic, the book also treats arguments pertinent to industrial accounting, such as:

-Classification and behavior of costs
-Cost/ Volume Analysis, Break Even Point
-Product Cost Accounting, Job Cost Accounting, Process Cost Accounting
-Standard Costs
-Cost Centers
-Estimate and Final Budget

Using the systematic treatment of these arguments contained within the text, a "script" was produced,specifically conceived with interactive teaching methodologies in mind.

So then, the descriptive part was limited tc 400-500 "pages" of video screens. Furthermore, "testing" video pages were developed in order to let the instructor, as well as the student, know what level of learning has been achieved . In developing these pages, nearly all the questioning techniques permitted by the authoring language Pilot were used.

Particular preference was given to multiple choice questions. They are, in my opinion, the best and most complete from an instructing standpoint.

To improve the teaching efficacy of the courseware, figures, pictures and charts have been included which have been adapted to a standard criteria in the paging of the text on the video, as well as ir the selection of colors used to give evidence to the information given.

The courseware, also includes parts of programs written in Basic which allow the student to develop exercises based or the theoretical arguments he comes across. In this sense, when one is dealing with a more important argument, the student is first shown a sample problem, and then he is asked to solve a similar problem using the calculating program sub-set which is previously put into the courseware.

The singular elements of the course have been connected to eachother in such a way as to allow the student to follow his own customized "learning trail" on the basis of his own capacities.

The courseware in question, including the description, interrogation, correction, suggestion, and simulation parts, is contained within seven chapters, sub divided into paragraphs for a total of circa 1000 video pages.

It has been written in PC- PILOT and BASIC, and for it's use it requires a Learning Station made up of an IBM Personal Computer of at least 265 K-RAM, a color graphic monitor, and a double floppy disk drive.

It's obviously not possible to establish, prio to it's use , how long a student will spend on the courseware, but it is safe to guess that on the average, he will need about 60-80 hours. The production time was about 1000 man hours, divided into 400 instructor hours, 300 analyst hours, and 600-700 programmer hours.

To allow the students to use the ideas learned through the reading of the book and the fruition of the courseware, a series of applicative softwares have been developed to meet any problems which frquently occur in the area of economic control, according to the criteria and methodologies already illustrated.

Keeping this in mind, a "Series of Software for Management" has been developed. This series deals with, among other things, the following arguments:

- Budget, Contribution Margin, Gross Margin
- Break Even Point
- Parametric Analysis
- Estimated and Final Budget
- Unitary Cost of Production
- Working Capital
- Cash Flow Analysis, etc.

4) CONCLUSION

With the production of a coordinated whole made up of a text book, a courseware, and a package of applicative softwares, it is intended to furnish an example of a new type of Interactive Unit to use both for the teaching and training fields, as well as for business purposes.

The unit in question was developed and thought of keeping in mind another, unconventional view of the problem. In fact, as we have already seen while designing the unit in question, we had already made up our minds to follow the twofold objective which follows:

1) Develop an applicative software, in a popular field, which is correlated to an appropriate and explanative support. Keeping this in mind, we have put together the applicative software with not only operational instructions, but with a textbook which emphasizes the criteria on which the calculating programs have been developed.

The knowledge of the theoretical criteria on which the applicative programs are based , should result to the end user as being not only very useful, but they should also allow him to acquire greater trust in the automatic calculating media which he is using.

2) Developing a teaching set which, while not relinquishing traditional modes of communication such as a written text, yet still employs the most recent communication media which advanced technology makes possible.

This teaching set, however, has been accompanied by an applicative software developed in congruence with the principles and methodologies already described in the development phase.
This is to allow the student to be able to employ the software in question , initially for training himself, and eventually to solve the various problems which arise in his professional activity.

Finally, then, the unit in question should be considered in two different ways, and they should both represent, in my opinion, an innovation.

A) A set of applicative programs accompanied by a text which illustrates the theoretical bases on which the calculating programs are based, along with a CBE courseware to improve the learning process of the argument in question.

B) A set made up of a conventional text, and CBE teaching coursewares along with a set of applicative programss which allow thw student to immediately utilize, in his professional activities, a package which elaborates the data based upon the same theoretical principles which the student has already learnec during the training period.

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